

[54] **ERASABLE, PROGRAMMABLE  
READ-ONLY MEMORY DEVICE**

[75] Inventor: Shoji Koyama, Tokyo, Japan

[73] Assignee: NEC Corporation, Tokyo, Japan

[21] Appl. No.: 706,332

[22] Filed: Feb. 27, 1985

[30] **Foreign Application Priority Data**

Feb. 28, 1984 [JP] Japan ..... 59-36504

[51] Int. Cl.<sup>4</sup> ..... H01L 29/78; G11C 11/40

[52] U.S. Cl. .... 357/23.5; 357/41;  
365/185

[58] Field of Search ..... 357/23.5, 41; 365/184,  
365/185

[56] **References Cited**

**U.S. PATENT DOCUMENTS**

4,258,378 3/1981 Wall ..... 357/23.5

4,376,947 3/1983 Chiu et al. .... 357/23.5

4,412,311 10/1983 Miccoli et al. .... 357/23.5

**OTHER PUBLICATIONS**

"Unintentional Writing of a FAMOS Memory Device During Reading", Kjell O. Jeppson and Christer M. Svensson, *Solid-State Electronics*, 1976, vol. 19, pp. 455-457.

*Primary Examiner*—Gene M. Munson

*Attorney, Agent, or Firm*—Burns, Doane, Swecker and Mathis

[57] **ABSTRACT**

An erasable, programmable read-only memory device comprises a plurality of memory cells of channel injection type. First and second impurity regions used as source and drain have different configurations such that when the same level of voltages are applied to first and second impurity regions, respectively, the intensity of electric field near the channel region in the depletion layer between the second impurity region and the substrate is weaker than that in the depletion layer between the first impurity region and the substrate. In the writing operation, a higher voltage in absolute value is applied to the first impurity region and channel current flows in one direction. Therefore, hot electrons can be effectively injected into the floating gate near the first impurity region. On the other hand in the reading operation, a higher voltage in absolute value is applied to the second impurity region and channel current flows in the opposite direction. The voltage in the reading operation is lower in absolute value than the voltage in the writing operation. According to such a device, the unintentional injection writing phenomenon in the reading operation can be suppressed.

**3 Claims, 6 Drawing Figures**

